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L. O. HOWARD, Chief.

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THE NEW MEXICO RANGE CATERPILLAR AND ITS CONTROL.[1]

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INTRODUCTION.

The New Mexico range caterpillar [2] (fig. 1) is regarded as a serious pest by the stockmen and farmers of eastern and southern New Mexico. It devastates large areas of range pasture and at one time threatened to destroy the live-stock industry over an area of 30,000 square miles. Formerly it fed only upon the range grasses, but of late has changed its feeding habits and now attacks many cultivated crops as well. The present destructive abundance of the pest is probably due to the fact that the natural enemies, in the form of parasitic and predacious insects, birds, and small mammals, were reduced in numbers through some severe climatic condition which, however, did not destroy the cater-

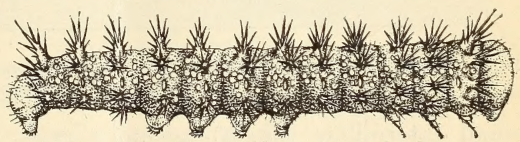

FIG. 1.—The New Mexico range caterpillar: Larva, fourth stage. Much enlarged. (C. N. Ainslie.)

[1] The purpose of this bulletin is to place before the stockmen and farmers of the Southwest the results of investigations carried on during the past three years concerning the control of the New Mexico range caterpillar.

[2] *Hemileuca oliviae* Ckll.; order Lepidoptera, family Saturniidae.

pillar. Without these natural checks the caterpillar multiplied and became destructively numerous. At the present time the introduced and native natural enemies are apparently reducing its numbers and it is hoped that it will soon cease to be a menace.

GENERAL DESCRIPTION OF THE RANGE CATERPILLAR.

The newly hatched caterpillars (fig. 2) are one-fourth of an inch long, dark brown or black in color, covered with fine prickles or spines, and may be seen during the cooler parts of the day feeding in groups. When not feeding, or during cold or wet weather, the

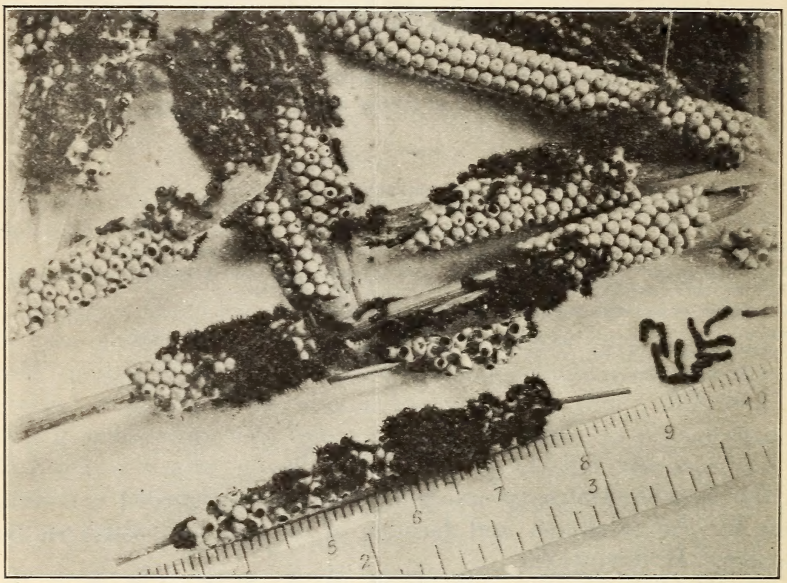

FIG. 2.—Hatching of the eggs of the New Mexico range caterpillar. Size of larvæ indicated by metric rule beneath. (C. N. Ainslie.)

small caterpillars (fig. 3) ascend a grass or weed stem and twine themselves together in a tight ball, for mutual warmth and protection against cold or rain. When in this position they are conspicuous objects upon the prairie. These small caterpillars feed upon their various food plants, growing rapidly larger, and as this occurs they separate from one another, and generally feed alone. In this process of growth the caterpillar "sheds its skin," or molts, five times, after each molt becoming larger and of a different color, gradually changing from the dark brown or black of the newly hatched caterpillars to a uniform light brown, then to a light brown streaked with yellow, and finally the full-grown caterpillars appear, yellow in color, with faint black markings. These full-grown yellowish caterpillars are from 2 to 3 inches long and as thick as a man's little finger, being

covered with clusters of sharp, poisonous spines. They remain in this stage about four weeks, and, owing to their large size, greediness, and great numbers, do their greatest damage at this time by devouring, or rendering unfit for grazing, most of the range grasses, and certain cultivated crops to a more limited degree, over large areas.

WHERE THE RANGE CATERPILLAR OCCURS.

At the present time the range caterpillar is known to occur in the northeastern and south-central portions of New Mexico, with a scattering infestation along the adjoining "Panhandle" of Texas. During the season of 1915 small colonies were found at Duran and Corona, in southern New Mexico. The parent moths have been found outside the limits mentioned, but in these localities no caterpillars have ever been discovered, although the surrounding country has been searched each year for evidence of their presence. It seems possible that this pest may eventually be found far to the southward of its present known limits, but the insect is now of great economic importance only in the northeastern corner of New Mexico, in the counties of San Miguel, Taos, Mora, Colfax, and Union.

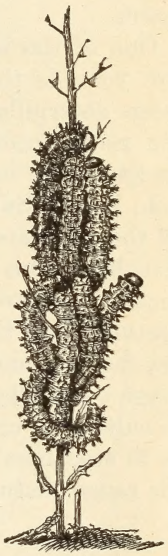

FIG. 3.—The New Mexico range caterpillar: Larvæ clustered on weed stem, to avoid the heated surface of the ground. (C. N. Ainslie.)

ITS ECONOMIC IMPORTANCE AND GREAT ABUNDANCE.

In many parts of the section just mentioned these range caterpillars, or "grass-worms," as they are popularly known, constitute a great menace to successful stock raising and farming. When the present investigations began, many stockmen and farmers were of the opinion that on account of the ravages of this insect it would be necessary to abandon stock raising in that part of New Mexico, which, as has been stated, includes an area of approximately 30,000 square miles, or about the area of Maine.

Owing to the constantly decreasing area devoted to stock raising, the economic importance of this caterpillar can not be overestimated.

The great abundance of these caterpillars should be taken into consideration in estimating the damage caused by the insect. In 1913 a total of 300 full-grown caterpillars were counted feeding upon an average square rod of pasture, 6 miles northeast of Las Vegas. This is at the rate of 30,720,000 of these large caterpillars per square mile. Many square miles in this section were similarly infested. The caterpillar is commonly found in numbers of from 100 to 200

to the square rod over all of the infested section. It is plainly evident that the tremendous abundance of the pest constitutes a grave menace to any crops attacked.

CROPS AND GRASSES ATTACKED.

The range caterpillar devours the range grasses down to, but not including, their roots. It feeds upon all the grama grasses, bunch grass, foxtail, side oats, wild rye, blue-joint, mesquite grass, buffalo grass, and even bluegrass on lawns. About 40 different kinds of grasses are included in the determined list of food plants of this insect.

One of the most important developments noted during the past two years is that of the apparent change of the food habits of the range caterpillar. In many instances, in addition to its damage to the range grasses, it has seriously injured cultivated grains and forage crops, including millet of various kinds, wheat, oats, barley, milo maize, Sudan grass, and, to a slight extent, corn and alfalfa. Of the cultivated crops, millet has appeared to suffer the most from attacks of this caterpillar. The damage to such crops has usually occurred where isolated farms were surrounded by infested range pastures. As the range country of New Mexico is rapidly becoming a dry-farming and irrigated agricultural district, it is evident that the range caterpillar, unless checked, is likely to become a serious pest to cultivated crops, and therefore of as much importance to farmers as to stockmen. However, it is at present primarily destructive to the range pastures.

CHARACTER OF THE INJURY.

The range caterpillar injures the crops in two ways: First, by eating the range plants down to the roots, over large areas, and in the case of cultivated crops by devouring the leaves; second, by poisoning the uneaten plants with the caterpillar spines, which it sheds in crawling from place to place or during the process of molting.

INJURY CAUSED BY PLANT FEEDING.

The injury caused by the range caterpillar in feeding upon various plants is the more important of the two, as it deprives the grazing stock of food and renders such cultivated crops as millet and Sudan grass unfit for forage. The greatest amount of damage is done during July and August, although some destructive feeding takes place during late June and early September. When the caterpillars are very numerous the range pastures for many miles will have the appearance of having been clipped by a lawn mower. Under these conditions many of the caterpillars die through lack of sufficient food to enable them to complete their growth.

In cultivated crops the caterpillars devour the leaves and, in rare instances, the upper and tender portions of the stem.

The caterpillars are very greedy and wasteful feeders, often eating only a small part of each plant destroyed. Frequently they will bite through a plant stem several inches below its top and then eat from this point down to the junction of stem and roots, leaving the upper part of the plant as waste. They are equipped with large, powerful jaws and eat a tremendous amount of plant matter each

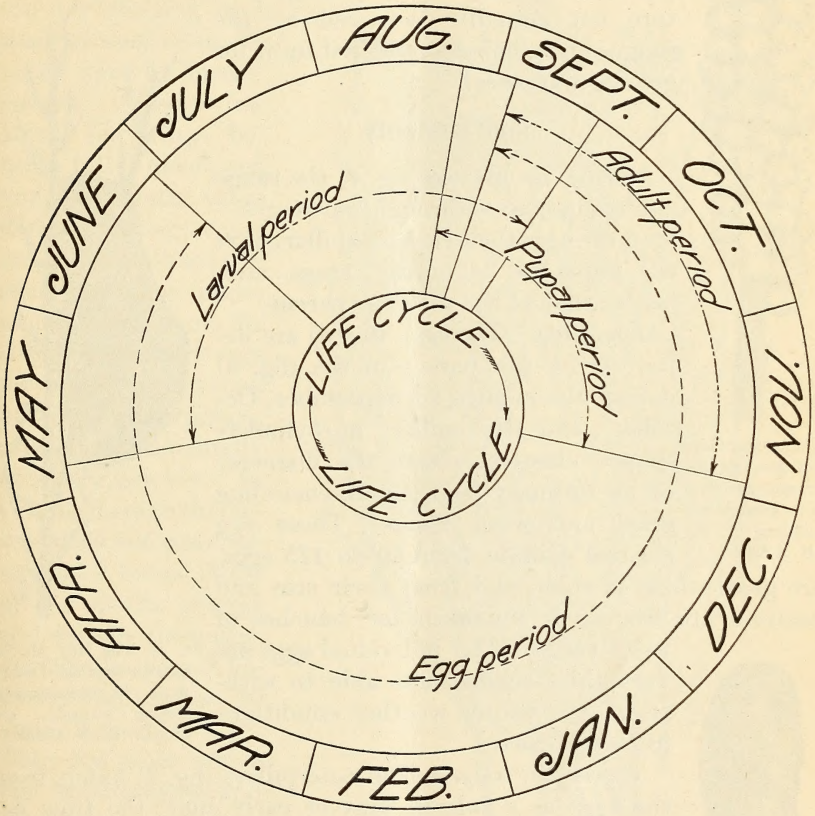

FIG. 4.—Diagram illustrating life cycle of the New Mexico range caterpillar. (Original.)

day. Much of this food is not fully digested, but passes through the caterpillar and is voided in an apparently slightly changed condition. Oftentimes it appears that the caterpillars eat from habit rather than necessity.

INJURY CAUSED BY POISONING UNEATEN PLANTS.

When partly grown the range caterpillars develop poisonous spines, probably as a protection against birds or insect-eating mammals. In crawling from place to place, or during the process of molting, these spines (see fig. 1) become scattered through the uneaten plants.

Upon coming in contact with the tender portions of the human skin, such spines cause at first an intense local irritation or smarting, which later results in a swollen and itching condition of the affected parts, resembling that caused by the sting of a wasp. It is possible that the same thing happens to the mouth of an animal feeding upon this grass, and that after one experience the plants are left untouched. At least the cattle seem to avoid grasses so affected. For this reason many areas of range pasture not actually destroyed by the range caterpillar are rendered unfit for grazing purposes.

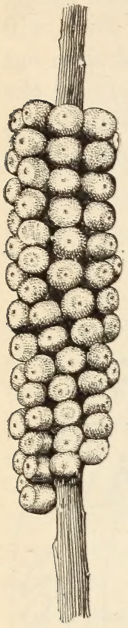

FIG. 5.—Egg mass of New Mexico range caterpillar on weed stem. Enlarged. (C. N. Ainslie.)

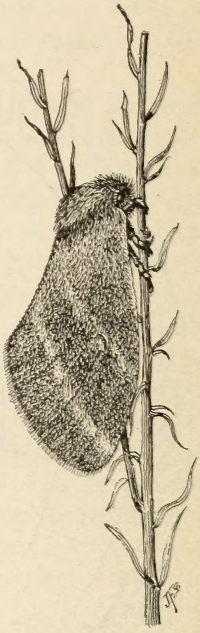

FIG. 6.—The New Mexico range caterpillar: Female moth in characteristic resting attitude. Enlarged. (C. N. Ainslie.)

LIFE HISTORY.

During its life (see fig. 4) the range caterpillar passes through four stages—first the egg, then the caterpillar, next the pupal or "spun-up" stage, and, lastly, that of the moth or parent.

Egg stage.—The eggs (fig. 5) are deposited by the parent moths (fig. 6) during the months of September, October, and November, in cylinder-shaped clusters, about the diameter of an ordinary lead pencil, encircling grass and weed stems. These egg clusters contain from 50 to 175 eggs, are pearl-white in color, and from their size and position are frequently mistaken for bunches of weed seeds. The individual eggs are very thick-shelled and able to withstand the winter weather conditions in New Mexico.

FIG. 7.—The New Mexico range caterpillar: Pupa, side view. Enlarged. (C. N. Ainslie.)

Caterpillar stage.—The caterpillars (fig. 2) hatch from the eggs as a rule in May or early June, the time depending upon moisture conditions. A certain amount of moisture appears to be necessary for hatching the eggs, temperature being of less importance. By late August or during September the caterpillars have completed their growth and are ready to enter the "spun-up" or pupal stage.

Pupal stage.—In entering its pupal or resting stage (fig. 7) the full-grown caterpillar draws the stems and leaf blades of any weed or grass plant together (fig. 8), and inside this foundation spins a rough, netlike inclosure or cocoon of yellow silk.

Inside this cocoon the pupa is formed. The pupa is dark brown in color, more or less cone-shaped, and from 1 to 1½ inches long. It is this process of "spinning up" that causes the matted and distorted appearance of the range plants from late August to the end of the year. The pupal period lasts for a month or six weeks and then the moth comes forth.

Moth, or parent insect.—The moth (see figs. 6 and 9), or parent, when freshly emerged bears only short, stubby wings, and may be seen during the early part of the day clinging to a grass or weed stem situated near its former cocoon. After a few hours the wings become fully developed and the moth takes flight. Mating occurs very soon after emergence from the pupa, and within 24 hours the female deposits her eggs for next year's brood of range caterpillars, after which she usually dies very quickly. In the moth stage this insect does not consume any solid food. Most of the moths emerge and deposit their eggs during the period between September 10 and November 15. They are most active just before sunset and are often so numerous as to give the impression of a snowstorm.

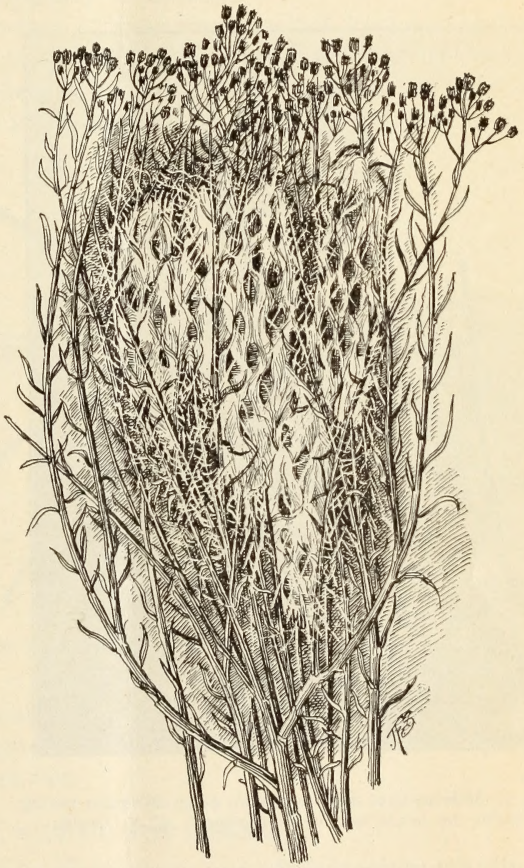

FIG. 8.—The New Mexico range caterpillar: A characteristic mass of cocoons in a single plant of Gutierrezia. Reduced. (C. N. Ainslie.)

The male and female moths differ in color and size. The male moth measures about 2 inches from tip to tip of the wings; his wings are white or light gray, and his body is covered with long, brick-red hairs. The female moth is larger than the male, being generally 2½ to 3 inches from tip to tip of the wings; her wings are reddish gray or dark brown and her robust body is dark reddish brown with white stripes on the lower side.

NATURAL ENEMIES OF THE RANGE CATERPILLAR.

Several kinds of natural enemies native to New Mexico are destroying the range caterpillar. To help these native forms, other kinds of natural enemies have been introduced.

NATIVE NATURAL ENEMIES.

A small percentage of range caterpillar eggs is destroyed by a four-winged, wasplike internal parasite. Two kinds of two-winged flies resembling house flies or blowflies lay their eggs upon the caterpillars, and the maggots hatching from them act as internal parasites, devouring the flesh and "insides" of the caterpillars. One of these flies is illustrated in figure 10. Furthermore, three kinds of wasplike internal parasites, one of which is shown in figure 11, have been found to destroy the pupæ. The effectiveness of such parasites in different localities varies from less than 1 to as much as 75 per cent of the caterpillars and pupæ present.

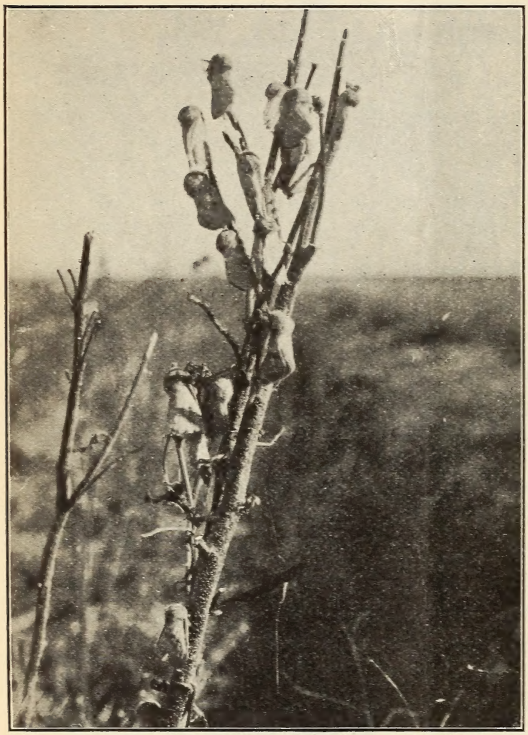

FIG. 9.—Male moths of the New Mexico range caterpillar resting during the day on stem of wild sunflower. (C. N. Ainslie.)

Skunks eat great numbers of range caterpillar pupæ and have been the means of practically exterminating the pest over certain areas. During the autumn season about 85 per cent of the food of the skunk, in the infested region, consists of these pupæ. This animal is very valuable as a destroyer of insects.

Badgers, coyotes, mice, and robins also feed upon the range caterpillar in its various stages. Several kinds of large ground beetles, some of the large ants, and robber flies prey upon the pest.

In some localities from 10 to 50 per cent of newly deposited eggs are destroyed by two different kinds of camel crickets.

INTRODUCED NATURAL ENEMIES.

Natural insect enemies, similar to those mentioned above, have been introduced into New Mexico from Massachusetts, Indiana, Kansas, Missouri, and California in an attempt to aid the native natural enemies already present. Some of these have established themselves in New Mexico and are at work helping to destroy the range caterpillar. None of these introduced insects, under any possible circumstances, could become injurious to crops.

Among the most important of these insects which have established themselves in New Mexico are three kinds of large ground beetles introduced from Massachusetts. One of these is illustrated in figure 12. Although only the above-mentioned insect enemies are known

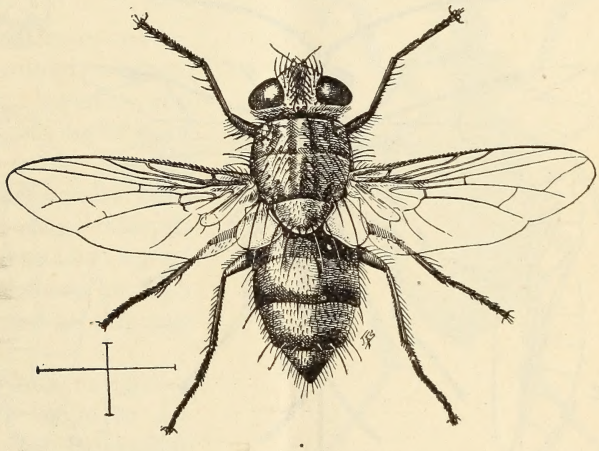

FIG. 10.— *Tachina mella*, a fly which is parasitic on the range caterpillar: Adult. Enlarged. (C. N. Ainslie.)

to be at work, additional natural enemies have been introduced to work upon the range caterpillar, and it is expected that they will soon make their presence felt.

A WILT OR ROT DISEASE.

A "wilt" or rot disease in favorable seasons kills many range caterpillars during the late summer. This happens at rare intervals during unusually wet weather, but owing to the semiarid conditions of this region the disease can not be depended upon to hold the range caterpillar in check.

DESTRUCTION BY HAIL.

Hailstorms often kill many full-grown caterpillars during August and September.

HISTORY OF THE RANGE CATERPILLAR.

As a result of complaints received from the stockmen of northeastern New Mexico concerning the ravages of the range caterpillar, a preliminary investigation was made during the period 1908 to 1912.[1]

It appears that no records exist of damage by this insect until about 1904—that is, five years previous to the beginning of the original investigations. There is no doubt, however, that the range caterpillar has been present in limited numbers in the section for many years, and probably for centuries. Taking these facts into consideration, it is probable that just previous to the date mentioned above some severe and unusual climatic condition caused the death of most

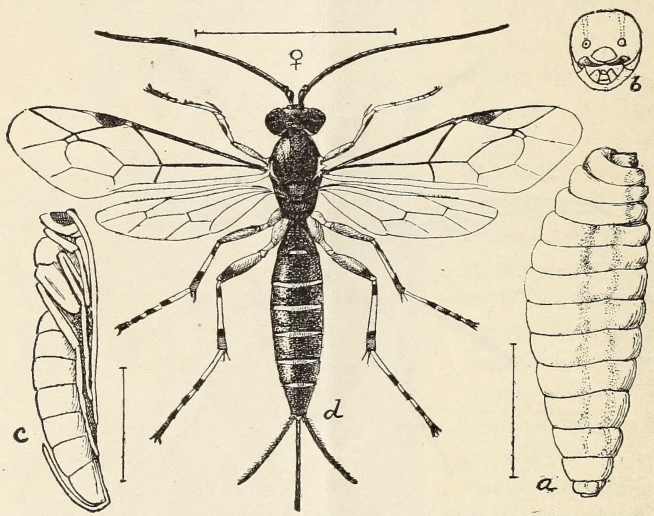

FIG. 11.—*Pimpla conquisitor*, a parasite of the range caterpillar: *a*, Larva; *b*, head of same; *c*, pupa; *d*, adult female. Enlarged. (*d*, C. N. Ainslie; *a*, *b*, *c*, redrawn from 4th Rpt. U. S. Ent. Comm.)

of the natural enemies of the range caterpillar but allowed the pest to survive, and in consequence to multiply rapidly and injure the range. These unusual climatic conditions might have been in the nature of a severe, long drought, or it might have been a mild, warm period in midwinter, followed by a rapid drop in temperature, conditions which occur in the plateau regions of New Mexico.

In 1913 a camp was established in the midst of badly infested range pastures on the open range 6 miles east of Koehler, N. Mex. To this camp natural enemies of the range caterpillar were brought from various parts of the country. Experiments carried on under temporary structures demonstrated that some of these natural enemies were effective against the pest and were capable of existing

[1] Ainslie, C. N. The New Mexico Range Caterpillar. U. S. Dept. Agr. Bur. Ent. Bul. 85, pt. 5, pp. 59–96, figs. 32–53, pls. 3, 4. 1910.

under New Mexico conditions. These were therefore liberated on the range.

After two years at this camp it became evident that permanent quarters were necessary, so a laboratory was established at Maxwell, N. Mex., where work against the range caterpillar and other cereal and forage-crop insects is now being carried on.

At the present time the native natural enemies are beginning to assert themselves again, and with the help of the introduced enemies it is hoped that the range caterpillar will soon be reduced to a point where it will cease to menace the stockmen and farmers of the Southwest.

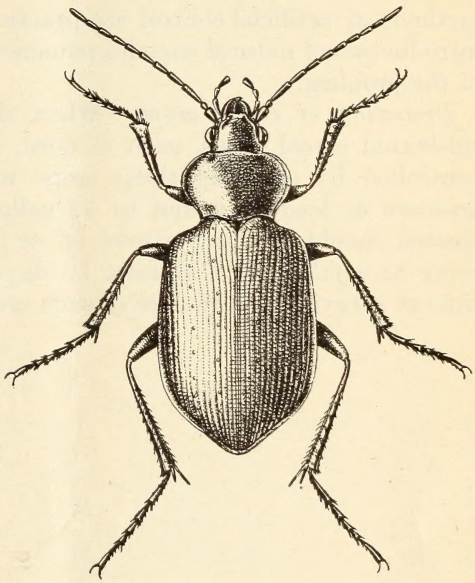

FIG. 12.—A predatory ground beetle, *Calosoma sycophanta*, introduced into New Mexico from Massachusetts to help in the destruction of the range caterpillar. About twice natural size. (Howard.)

CONTROL MEASURES.

Mechanical measures, such as burning the range, rolling the ground, and brush dragging have been suggested as a possible means of artificially controlling the range caterpillar. The pasturing of turkeys and sheep has also been proposed as a means of control.

Burning the range.—Burning the range to destroy the range caterpillar has been tried out on several occasions, but has not proved successful on a large scale because of the lack of sufficient vegetation on most of the range to support a hot running fire. Under certain favorable circumstances the winter burning of restricted areas has proved of great benefit in destroying the overwintering egg clusters. Cultivated areas usually may be protected by winter burning the surrounding egg-bearing grass, weeds, or other vegetation. However, such burning destroys the grass crop for that year, and unless carefully conducted may result in the burning of buildings or timber in the vicinity.

Rolling the ground and brush dragging.—Rolling the ground with a heavy corrugated iron roller proved expensive and killed only a small percentage of the caterpillars present, on account of the tufted or uneven condition of the surface. Brush-dragging the small caterpillars gave similar results.

Use of sheep and turkeys.—The pasturing of sheep might prove effective in killing range caterpillars or pupæ over small areas, but this method would not be practical on the vast expanse of the cattle ranges. Turkeys kept in confinement refused to eat the range caterpillar, and it therefore seems probable that they would not accept them as food on the range.

General considerations.—In any method for destroying the range caterpillar, the low value of the range land must be taken into consideration. This land sells for $5 or $10 per acre and rents at from 2 to 10 cents per acre. It will thus be seen that none of the foregoing methods of artificial control are practical on range land. Thus the introduction of natural enemies remains as probably the best solution of the problem.

Protection of cereal crops.—When this pest is found attacking cultivated cereal crops, such as corn, sorghum, or kafir, it can be controlled by spraying these crops with a solution of powdered arsenate of lead, 1 pound to 50 gallons of water. But crops so treated should not be pastured off or fed to stock *until after heavy rains have fallen,* and at least 30 days should elapse between the time of spraying and the use of such crops as forage.

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